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ECONOMICS AND MANAGEMENT IMPLICATIONS OF CAMPGROUND IRRIGATION: A CASE STUDY

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ABSTRACT

Irrigation of campgrounds can aid in establishing and maintaining ground-cover vegetation; however, it introduces new administrative problems and increases costs of campground construction and maintenance. At Point Campground in central Idaho, costs of irrigation were $0.26 per visitor-day; benefits must be subjectively evaluated. Improved campground design can reduce the costs and minimize problems of administration.

In some campgrounds, irrigation will be considered as a means for facilitating revegetation. Managers must examine (1) the cost and anticipated benefits of an appropriate system of irrigation, and (2) the problems of accommodating campground visitors to the system. As is frequently the case in investment for recreational uses, the benefits of vegetation improvements are primarily esthetic. Although costs can be quantified fairly easily, managers must subjectively decide whether such investments are justified.

Using a case study to provide insight into the questions of benefit and cost, this paper describes an irrigation system in a redesigned and reconstructed campground. Additionally, the study suggests many problems which may be encountered elsewhere during campground irrigation, together with possible alternative solutions.

THE STUDY AREA

Point Campground in the Sawtooth National Forest, Idaho, is a 17-family unit campground that occupies a 12-acre peninsula on Redfish Lake near the Sawtooth Primitive Area. It has been a very popular "destination campground" since first being opened in 1935. In 1969 it received 6,200 visitor-days' use. The climate at this 6,500-foot elevation is cool and dry; 10 frost-free days are considered normal; average rainfall during the summer season is 7 inches. Although congenial for summer recreation, the climate is not conducive to luxuriant vegetation. Moreover, the short season available for effective plant growth coincides with the season of heavy tourist use.

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Native vegetation consists of several grasses and forbs as well as bitterbrush, lodgepole pine, and some Douglas-fir and aspen. After 30 years of camping and picnicking use, less than 15 percent of the ground surface area was covered with vegetation. Although no records were available, the site originally must have supported closer to 70 percent ground cover judging from the present condition of undeveloped areas adjacent to the campground.

SITE RECONSTRUCTION

Point Campground was closed and completely redesigned and rehabilitated from 1965 through 1967 and reopened for use in July 1968. An adequate supply of water is piped 2,500 feet through a single pipe from Fishook Creek to the campground. There, culinary water is diverted for minor chlorination treatment and piped to drinking hydrants and washrooms. Untreated irrigation water is delivered to a "rainbird" sprinkling head at each family unit. The capacity and pressure of the system delivers 6 gallons per minute to each of the 17 sprinkling heads, each of which waters an area 110 feet in diameter (fig. 1).

For experimental purposes, only eight family units are currently receiving water in a study designed to test the effectiveness of water, fertilizer, and seed in establishing and maintaining adequate ground cover vegetation on an old and worn site.[2]

COSTS OF THE IRRIGATION SYSTEM

The campground irrigation system represents an addition to the basic water system required for delivery of water for culinary use by campers and for a flush toilet facility. Without the irrigation system, the pipeline, hydrants, treatment equipment, and toilet facilities would have cost $45,600. Irrigation required additional investment at several points: larger capacity pipe from the water source to the campground, pipe for delivery of water to each family unit, underground valves and sprinkler heads. These added costs were $11,400, or $670 per unit.

Irrigation of the campground necessitated added costs for operation and maintenance of the system during the growing season. Weekly operating costs, from mid-June to mid-September, were estimated to be $35, or $420 per season. Annual maintenance of the system costs approximately $280. Therefore, total annual operation and maintenance costs were about $700, or $41 per unit.

The irrigation system should have a useful physical life of at least 20 years. Over this period, the annual cost of the system would be $915 per year, assuming an interest rate of 5 percent on the initial ($11,400) investment. Per family unit, the costs would be $54 per year.

Therefore, the total annual cost of capital investment in the system, operation, and maintenance, expressed on a per family unit basis is $95. Based on the 1969 season use-level (365 visitor-days per unit), this cost is $0.26 per visitor-day.[3] This amounts to approximately $1 per night for a family of four persons.

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[2]Roscoe B. Herrington and Wendell G. Beardsley. Improvement and maintenance of campground vegetation. USDA Forest Serv. Res. Pap. INT-87, 9 p. 1970.

[3]Although only eight units (randomly located) were actually watered, additional costs incurred to water all 17 units would be negligible. The irrigation system already extends to the other units. The additional labor required to turn on nine extra sprinklers would be minimal and would be accomplished while walking between the currently watered units.

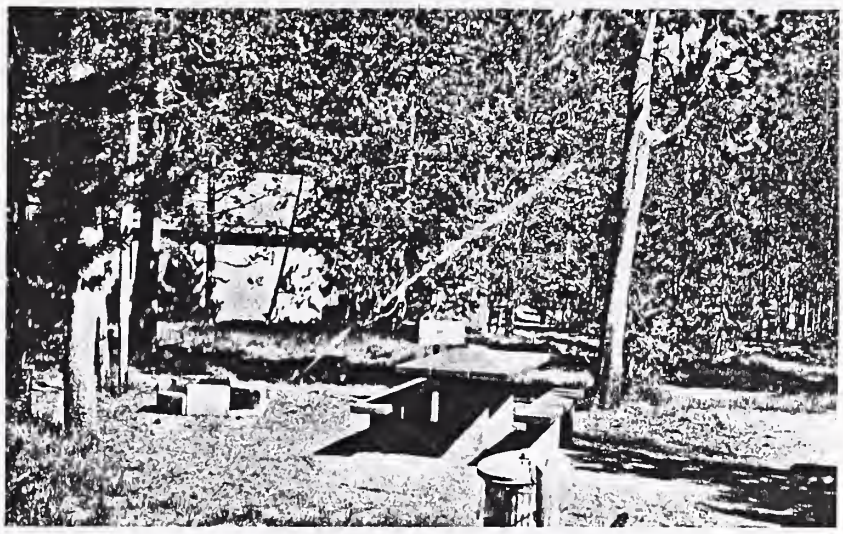

Figure 1.--A "rainbird" sprinkler was used to irrigate a family unit at Point Campground, Sawtooth National Forest, Idaho.

One further (but less obvious) cost which cannot be ignored is the loss of campground capacity necessitated by irrigating Point Campground. All visitors were excluded Tuesday afternoon and night of each week to permit sprinkling. Therefore, as much as one-seventh of the annual benefits of visitor-use would have been lost had the camp been fully occupied. If a daily overnight fee for use were charged, as much as one-seventh of total revenues would be lost because of the irrigation program. While the magnitude of these costs at Point Campground cannot be quantitatively expressed, they should be considered along with many of the immeasurable benefits of the irrigation system.

BENEFITS OF IRRIGATION

Although the costs of providing irrigation in campgrounds are for the most part readily assembled, the benefits resulting from this activity cannot be evaluated in monetary terms. Most of the benefits generated accrue directly to individual campground users as increased satisfaction from the camping experience. Some benefits may flow to the campground managers in the form of reduced maintenance costs. For example, the more succulent vegetation may reduce fire risk, or cleanup cost may be reduced if the neater, fresher appearance of the campground induces less littering by visitors.

The benefits from irrigating Point Campground include: (1) esthetic benefits to visitors from increased grass, herb, and shrub cover around family units, (2) decreased dust and mud conditions, (3) decreased ground fire hazard, and (4) the weekly cleansing effect of the water on the table and grill facilities and surrounding area. After 2 years of treatment, the campground seems generally greener and cleaner. Units receiving water, fertilizer, and seed had 49 percent grass, herb, and shrub cover; units receiving fertilizer and seed only had 17 percent cover.[4] These and other benefits of increased vegetative cover must be subjectively evaluated at each campground for use in investment decisions.

[4]Herrington and Beardsley, op. cit.

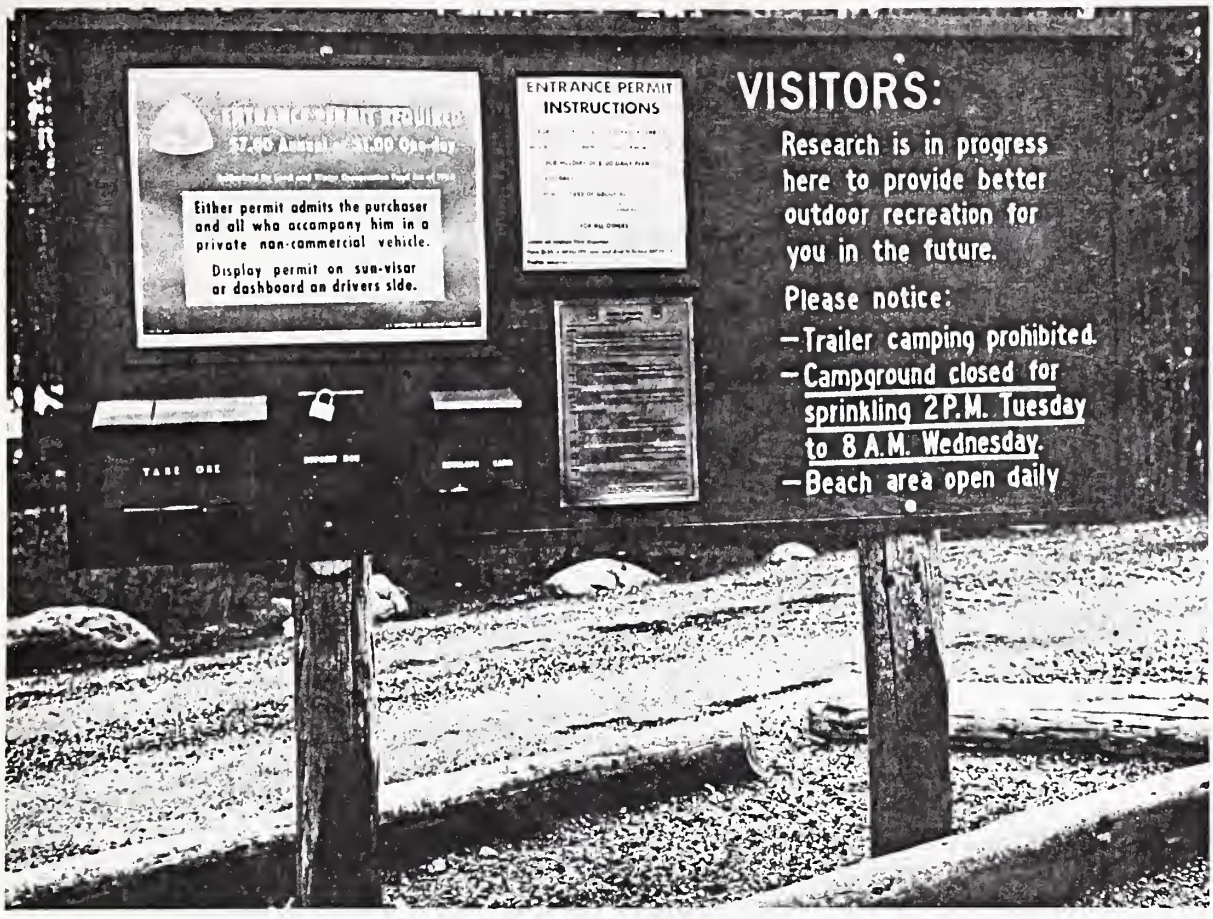

Figure 2.--Entrance sign explains weekly closure of Point Campground for sprinkling.

OPERATION OF THE IRRIGATION SYSTEM

A basic problem at Point Campground was accommodating visitors to an irrigation schedule under which large volumes of water at high pressure were sprayed 1 day each week over each unit. Several possible alternative solutions were considered and will be discussed later. The method selected was to require all visitors to vacate the entire campground on a scheduled basis 1 day each week. This seemingly drastic solution was the most workable and efficient from an administrative standpoint. Eight hours of sprinkling were required to apply a minimum of 1 inch of water, after which a drying-out period was desirable to allow drainage of surface water and to prevent excessive damage from trampling while the vegetation was in a wet, turgid condition.[5]

The campground was closed each Tuesday at 2:00 p.m. and reopened at 8:00 a.m. Wednesday. Watering was done from 2:00 p.m. to 10:00 p.m. These special regulations and the reasons for them were explained to visitors at the entrance by using brochures and a sign (fig. 2). Additional information about the program, explanation of the regulations, and enforcement of them were provided by the campground guard. These

[5]Previous experimental results indicated excessive levels of damage when vegetation is trampled immediately after watering. See: J. Alan Wagar, Cultural treatment of vegetation on recreation sites. Soc. Amer. Forest. Proc. 1965: 37-39.

special precautions probably explain the surprisingly cooperative visitor reaction, and may provide a model program for use elsewhere. Visitors were often quite interested in the research program; almost no adverse reaction was reported by Sawtooth Valley District personnel. Many visitors who were required to move out on Tuesday afternoon were observed waiting to reenter on Wednesday morning. Their willingness to undertake the inconvenience of moving camping equipment twice attests to the desirability of the site, one factor of which may be the improved condition of vegetation.

DISCUSSION

Installation and operation of such an irrigation system creates many problems of concern to managers. The experience from Point Campground suggests factors that must be considered so that a unique, functional system can be designed within the constraints encountered at other individual campgrounds. These factors can be assigned to three classes: (1) Physical characteristics of the site, (2) design and construction of the campground, and (3) visitors who use it. These are discussed below.

Site characteristics.--Several site factors relevant to a functional irrigation system are important: distance to and volume of the water supply, water absorption, and retention capacity of soils in the campground, slope steepness of areas to be watered, location and size of existing vegetation, and normal precipitation patterns.

Costs of campground irrigation are strongly influenced by the availability of adequate water supplies. At Point Campground, water was available only 2,500 feet from the site in more than sufficient quantity. In areas where water is not available reasonably near the site, hauling water in tank trucks is possible, but at substantially higher cost. With this alternative, water could be hauled and stored until a sufficient quantity was available to water the campground, or several units simultaneously. Alternatively, units could be individually watered directly from the truck as water is delivered to the site. This would eliminate storage tanks and the pipeline delivery system, but substantially increase labor required during watering. Experience with hauling water at a campground in northern Utah indicated the approximate annual cost for irrigating 12 units would be about $1,800, or $150 per unit. On a per-unit basis, this represents more than a 50-percent increase in the costs encountered at Point Campground with the underground irrigation system. Included were wages of one full-time laborer for 3 months, tank truck rental, pumps, hose, and sprinkler head equipment. One-way haul distance was 3 miles. The truck hauled 700 gallons per trip and the water was pumped directly from the truck onto the unit. A total of 1,750 gallons was required to water the 53- by 53-foot test plot at each unit. Although this approach was expensive in terms of labor required, it permitted watering individual units as they became vacant and eliminated the inconvenience of moving suffered by the visitors at Point Campground.

Soils and slopes found at different sites may present additional constraints for irrigation. Impervious or highly erodible surface soils limit the rate at which water may be applied. Similarly, water might run off sloped areas too rapidly to permit satisfactory infiltration to the root level of plants. Mulching and leveling might help alleviate these problems at some sites. In any event, soil and topographic conditions will influence the specifications for output rates of sprinkler heads.

Existing vegetation--particularly trees and taller shrub species--must also be considered in the selection and location of sprinkler heads. Such vegetation can interfere with the designed pattern of water distribution from a particular sprinkler head. Moreover, young thin-barked trees can be seriously injured by the impact of a high pressure stream of water.

Patterns of rainfall will influence decisions regarding irrigation systems. For example, an area may ordinarily receive adequate rainfall for all but a short period of

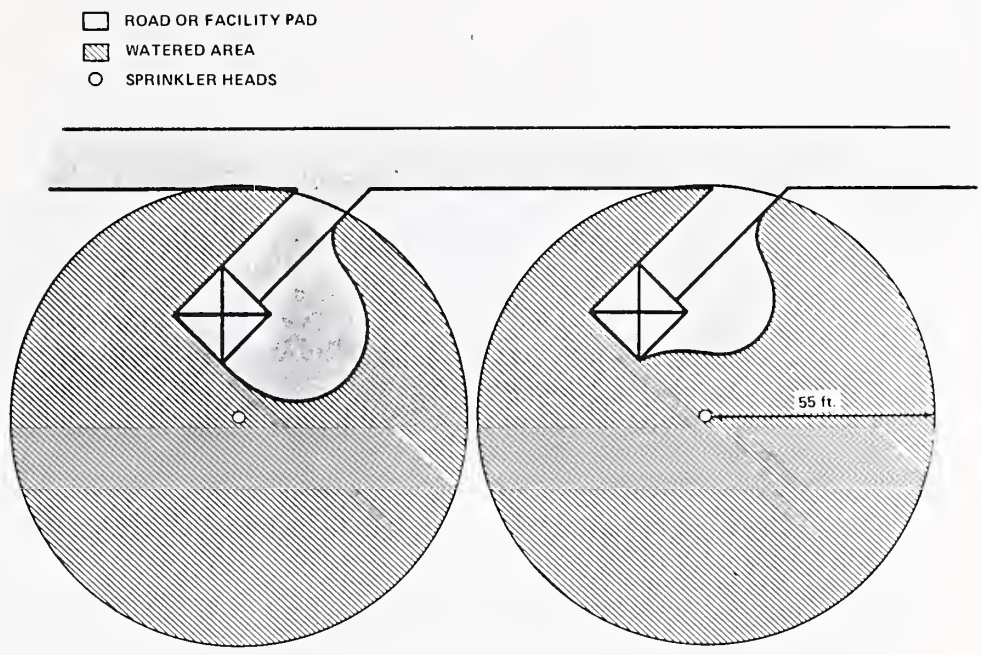

Figure 3.--Present design of camp units at Point Campground. A single sprinkler waters the entire unit but water cannot be excluded from the facility pad area.

the season. In such cases, one or two sprinklings per season may be adequate. This could be accomplished using hoses rather than by installing an expensive underground system. Watering with hoses might also be sufficient when extra moisture is needed only to facilitate germination of newly-planted grass seed.

Campground design and construction.--The shape of the family unit can complicate or simplify irrigation. The area immediately adjacent to the facility pad at each camping unit is the "critical zone" as far as watering is concerned. Because of its location, vegetation within 10 feet of the facility pad is most likely to receive trampling; for this reason, such vegetation needs supplemental watering more than does vegetation growing farther away from the facility pad.

Conventional design of family unit facilities creates problems of incompatibility between visitor occupancy and efficient watering. It is difficult to water the critical zone without getting water on the table, tent pad, and fire grill. At Point Campground, the sprinkler head at each unit sprayed water 55 feet in a complete circle from a point near the facility pad (fig. 3). This pattern provided adequate water for the critical zone. However, the high pressure of the water would quickly penetrate and soak visitors' tents or other equipment at the unit; furthermore, such obstructions to the stream of water prevent uniform watering of the entire unit and create dry spots. For these reasons, visitors could not remain at a unit while it was being watered.

Solutions other than the one used at Point Campground are possible. First, without altering the basic unit design for Point Campground, additional rainbird-type sprinkler heads, each watering only a segment of a circle, could be installed at each unit so that most water could be excluded from the facility pad (fig. 4). This change would eliminate the need to vacate the campground; visitors and their equipment would not be directly sprayed, but wind might carry some water onto the facility pad. However, this alternative is less efficient in the application of water because it fails to reach some areas in the critical zone immediately adjacent to the facility pad. The approximate additional investment for the extra feeder pipes and sprinkler heads at Point Campground would be $100 per unit. This would increase the total annual cost from $95 to $103 per unit.

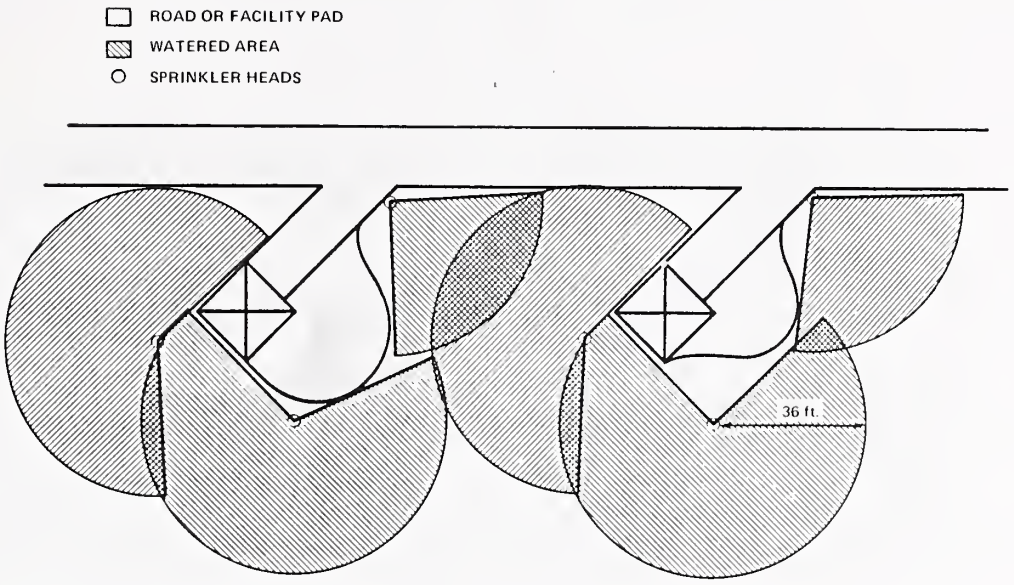

Figure 4.--Water is excluded from the facility pad area if three sprinklers are used. However, parts of the critical zone adjacent to the facility pad may not be adequately watered.

A second alternative would be a redesign of family units to fit a nonwatered sector of a circle as illustrated in figure 5. With such a layout, administrative problems would be reduced, operation of the system would be simplified, and visitors might remain on the facility pad area during sprinkling. The unwatered area adjacent to the facility pad would be minimized. However, this solution is workable only for new construction or major reconstruction.

As a third alternative, each unit could be individually watered as it became vacant. A 7-day camping limit would insure at least weekly watering of each unit.

Sprinkler heads other than the rainbird type may be needed to efficiently water the critical zone. A group of fountain heads, such as those commonly used on residential lawns, could be arranged to water the critical area without getting the table-grill facility area wet. The larger rainbird heads could then be used to water the surrounding areas.

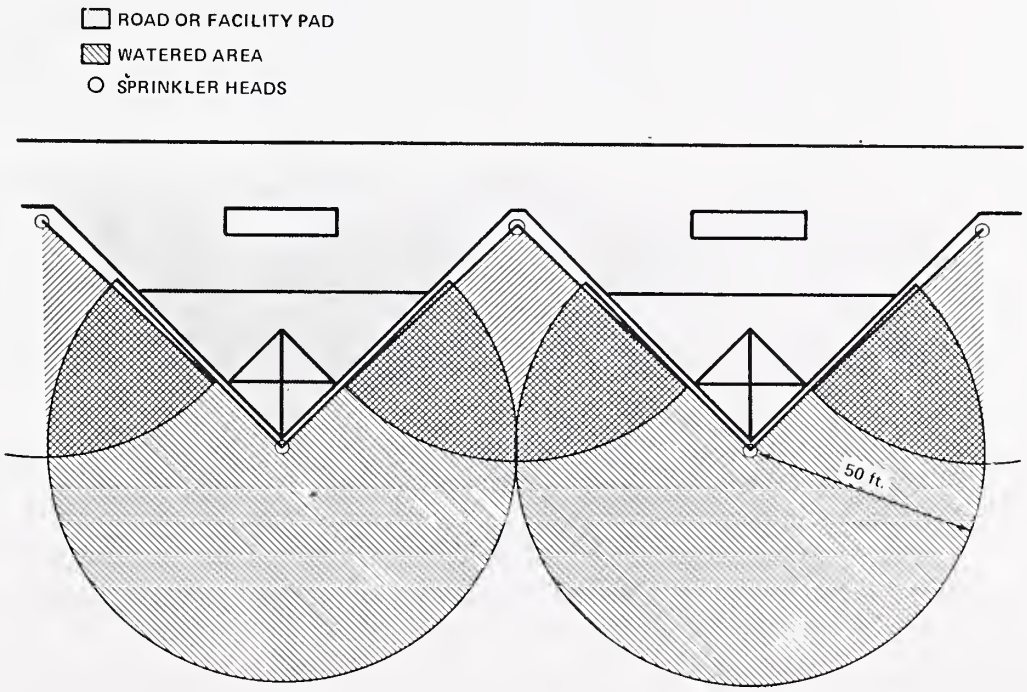

Figure 5.--Redesigned family units could be easily watered while visitors remain on them. Virtually all of the critical area adjacent to the facility pad is adequately watered.

At some point, the sheer size of a campground makes simultaneous watering of all units impossible or impractical. In such cases, available water supply dictates the maximum number of units which can be watered at one time. This fact may influence design criteria for new campgrounds. In the older campgrounds, it might necessitate devising some way of closing portions of the site during watering. Point Campground's road system contained two separate "loops"; this would permit the closure and watering of each half at different times. At other sites, the irrigation system design must be planned to permit watering within the particular restraints encountered.

Visitor-use problems.--All of the alternatives suggested for irrigating camp units have conflicts between visitor-use and watering. If visitors remain at or near units being watered, children might play in the spray and puddles, thus damaging ground-cover vegetation. Or, visitors might shut off or tamper with sprinkler heads, reducing the amount of water applied. On the other hand, extra revenues or benefits from the additional visitor-use might be sufficient to provide a full-time attendant to operate and supervise the system, if the irrigation system can be arranged so that visitors are not forced to vacate.

A system of separate watering days for different sections of the campground may create public relations problems when some visitors must vacate while others remain. Also, it may force some visitors to move more than once in a single week. Where visitors must vacate, additional camping space should be available to them in other nearby campgrounds. At Point Campground, an overflow camping area, normally used only during holiday periods, accommodated the displaced visitors. Watering, of course, was not scheduled during peak-use holidays when the overflow area normally would be filled.

CONCLUSIONS

Irrigation of recreation sites introduces a wide array of problems in several areas (site design, cost, engineering, and public relations) that have not previously concerned campground managers.

One major problem will be to develop a means of sprinkling that will not excessively inconvenience visitors or require them to vacate camp units. This problem can be solved to a large degree through modifications in the design of future campgrounds. New campground construction should not be initiated without carefully considering the possible future need for irrigation and its impact on the shape, size, and spacing of family units.

Irrigation in many existing campgrounds will remain awkward. It is possible to water as vacancies occur in the more lightly-used campgrounds. This technique is less practical for heavily-used sites such as Point Campground where units are seldom vacant. In such situations, the manager will be forced to either (a) periodically close all or part of the campground, and thereby reduce the benefits of public use, (b) restrict irrigation to those parts of the campground where it will not inconvenience visitors, or (c) devise some more costly combination of sprinkler heads that will permit watering without annoyance.

At Point Campground, annual costs for irrigation were $95 per family unit, or about $0.26 per visitor-day of use in 1969. Benefits from irrigation, while not quantifiable, include improved appearance, decreased dust and mud conditions, reduced fire hazard from higher levels of vegetative cover, and a weekly "washing-off" of the facility pad area. At other sites, these and other benefits can be subjectively compared with costs as developed above in irrigation investment decisions.